CLAIMS

1. A network stack comprising:
a plurality of network units each of which includes a multiplicity of ports for receiving and forwarding addressed data packets, at least two cascade ports and a switching engine for forwarding received packets to at least one port in accordance with address data in the packets,
and a cascade connection comprising for each of two opposite directions around the stack at least one unidirectional path for data packets composed of links each between a respective cascade port on a network unit and a corresponding cascade port on the next network unit.

2. A network stack according to claim 1 wherein there are at least two unidirectional paths for packets for each of the two opposite directions around the stack, each path including a respective cascade port on each network unit.

3. A network stack according to claim 1 wherein in a normal mode of operation of each network unit the respective switching engine directs packets received at a cascade port and intended for further transmission on the cascade out of the same cascade port and in a loop-back mode of operation of a unit the switching engine directs packets received at a cascade port and intended for further transmission on the cascade out of a different port and in a changed direction of progress around the stack.

4. A network stack according to claim 3 wherein each network unit includes means for detecting an operational failure between that network unit and an adjacent network unit to cause the network unit to enter the loop-back mode.

5. A network stack according to claim 3 wherein each network unit is operable in a bypass mode wherein packets proceeding on the cascade connection and received at a cascade port are forwarded from the same port without being redirected by the switching engine.

6. A network stack according to claim 3 wherein each switching engine is responsive to control data conveyed between the network units on control paths separate from the said unidirectional paths.

7. A network stack according to claim 6 wherein said control paths are constituted by a chain of half-duplex links each from one network unit to the next and wherein each network unit includes cascade control logic which responds to control frames on respective links to control the switching engine of the respective network unit.

8. A network stack according to claim 1 wherein each packet which is received at any given port from an external network and is forwarded onto the cascade connection includes a header source field which uniquely across the stack identifies the given port and the respective network unit.

9. A network stack according to claim 8 wherein the header source field is a multiple bit binary field of which a first plurality of bits identifying the given port within its network unit and a second plurality of bits identify the respective network unit.

10. A network stack according to claim 1 wherein each packet which is forwarded onto the cascade connection includes a header destination field for identifying a destination network unit and a port thereon and another field which indicates the validity of the header destination field.

11. A network stack according to claim 1 wherein each packet which is received at any given port from an external network and is forwarded onto the cascade connection includes a header source field, which uniquely across the stack identifies the given port and the respective network unit, and a header destination field for identifying a destination network unit and a port thereon, the header source field and the header destination field having the same format.

12. A network stack according to claim 1 wherein each packet which is forwarded onto the cascade includes a header portion which indicates which of the network units in the stack have been traversed by the packet.

13. A network stack according to claim 12 wherein the header portion is a bit mask.

14. A network unit which is capable of use in a cascade stack of network units and includes:
a multiplicity of ports for receiving and forwarding addressed data packets;
a switching engine for forwarding received packets to at least one port in accordance with address data in the packets; and
at least two cascade ports for connection to other network units in the stack,
wherein said switching engine provides a normal mode wherein packets received at any of the cascade ports are forwarded from the same port in the same direction of progress and a loop-back mode wherein a packet received at a cascade port is forwarded from a different cascade port in a different direction of progress.

15. A network unit according to claim 14 wherein the network unit is responsive to control data indicating the operational status of other network units in the stack to determine the mode.

16. A network unit according to claim 14 and having a bypass mode in which packets received at a cascade port and intended for further transmission on said cascade are forwarded from the same port without being redirected by the switching engine.

17. A network unit which is capable of use in a cascaded stack of network units and includes:

a multiplicity of ports for receiving and forwarding addressed data packets,

a switching engine for directing received packets to at least one port in accordance with address data in the packets;

at least two cascade ports for receiving packets from and sending packets to adjacent network units in the cascaded stack; and

means for detecting an operational failure between this network unit and an adjacent network unit in the stack and for controlling the switching engine to redirect packets which would otherwise be sent from a particular port to that adjacent network unit to be forwarded from another port whereby to be sent to a different network unit in the stack.

18. A network unit according to claim 17 wherein the unit is responsive to control data indicating an operational failure between two other units in a stack to enter a bypass mode to cause packets received at a cascade port and intended for further transmission on the cascade to be forwarded without being re-directed by the switching engine.

19. A network unit according to claim 17 wherein the unit has at least one cascade port for reception and forwarding of packets in a first

direction around the cascade and at least one cascade port for reception and forwarding of packets in a second direction around the cascade.

20. A network unit according to claim 19 and having at least two cascade ports for each of the first and second directions.

21. A network unit according to claim 17 wherein the unit includes control logic for forwarding control frames to and receiving control frames from one each of two control paths and for thereby determining the operational status of other network units so as to control said switching engine.

22. A network unit according to claim 21 wherein the control logic detects said operational failure.

23. A network unit according to claim 17 and operative to provide for each packet that is forwarded from a cascade port a header which includes a destination port field that identifies a destination port and the network unit on which that destination port is located

24. A network unit according to claim 23 wherein the header includes a field that indicates the validity of the destination port field.

25. A network unit according to claim 24 wherein the said header includes a source port field which identifies a source port by which the packet has been received and the network unit on which that source port is located.

26. A network unit according to claim 17 wherein the unit provides for each packet that it forwards from a cascade port a header portion which

identifies which network units in a stack have and have not been traversed by the packet.

27. A network unit according to claim 26 wherein said header portion is a bit mask.

28. A network unit according to claim 26 wherein the unit responds to said header portion to discard the packet if said header portion indicates that the packet has already traversed the unit.

29. A network unit according to claim 26 wherein the unit responds to said header portion and to an indication that a destination port for the packet is known to determine whether the destination port is on the unit and the unit responds to said header portion and to an indication that a destination port is unknown to perform a look-up in an address database for the destination port.

30. A network unit capable of use within a cascaded stack of network units, and including:

a multiplicity of ports for receiving addressed data packets from and sending packets to an external network;

a look-up database for relating address data in packets to forwarding data which includes an identification of at least one port and a switching engine which responds to forwarding data to direct packets to at least one corresponding port; and

at least one cascade port for transmission of data packets between the unit and other units in the cascade stack;

wherein the unit provides for each packet that it receives at one of the said multiplicity of ports and forwards from a cascade port a header field that indicates whether a destination port in the stack is known for the

packet and a header field for identifying the destination port and the unit on which the destination port is located.

31. A network unit according to claim 30 wherein the header includes a source port field that identifies a port at which the packet has been received and the unit containing that port.

32. A network unit according to claim 30 wherein each packet forwarded from the cascade port includes a field which has portions for denoting which of the units of the stack have been and have not been traversed by the packet.

33. An addressed data packet for use within a cascaded stack of network units which each have a multiplicity of ports for receiving and forwarding data packets, the addressed data packet including a header which includes a first field and a second field which are in a common format and uniquely identify a source port and network unit on which the packet has been received and a destination port and network unit from which the packet is to be forwarded.

34. An addressed data packet according to claim 33 wherein each of the first and second fields is a multiple-bit word of which a first plurality of bits denote a port and a second plurality of bits denote a network unit.

35. An addressed data packet according to claim 33 and including a third field for indicating whether the destination port and network unit are known.

36. An addressed data packet according to claim 33 and including portions which conform the packet to an Ethernet transmission protocol.

37. An addressed data packet for use within a cascaded stack of network units which each have a multiplicity of ports for receiving and forwarding data packets, the addressed data packet including a header including a field for indicating whether a destination port and network unit are known and a field for identifying the destination port and network unit from which the packet is to be forwarded.

38. An addressed data packet according to claim 37 wherein the field for identifying is a multiple-bit word of which a first plurality of bits denote a port and a second plurality of bits denote a network unit.

39. An addressed data packet according claim 37 and including portions which conform the packet to an Ethernet transmission protocol.

40. A network unit capable of use within a cascaded stack of network units, and including:
a multiplicity of ports for receiving addressed data packets from and sending packets to an external network;
a look-up database for relating address data in packets to forwarding data which includes an identification of at least one port;
a switching engine which responds to forwarding data to direct packets to at least one corresponding port; and
at least one cascade port for transmission of data packets between the unit and other units in the cascade stack;
wherein the unit provides for each packet that it forwards from a cascade port a header field which has portions for denoting which of the network units of the stack have been and have not been traversed by the packet.

41. A network unit according to claim 40 and including means for discarding the packet when the respective header field indicates that the packet has already traversed the network unit.

42. A network unit according to claim 41 wherein the network unit discards the packet if the respective header field indicates that the packet has traversed all the network units in the stack.